

Numeric Nutrient Criteria

Background, Current Efforts, Nutrient Work Group



Wyoming Water Association

October 30, 2014

Outline

- Background on Nutrient Pollution
- History
- Criteria Development in Wyoming
- Nutrient Reduction Strategy
- Nutrient Work Group



Nutrients

Nutrients = Nitrogen and Phosphorus



Nutrients

Essential and Economically Important



Overabundance of nutrients



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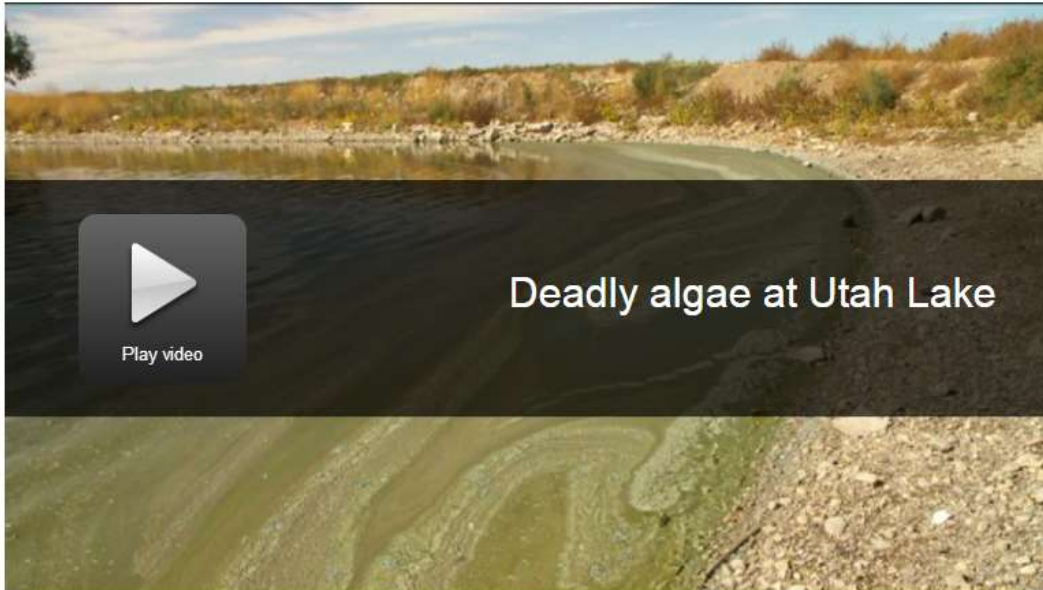
Impacts of Nutrient Pollution



Dog dies after exposed to toxic blue-green algae in Utah Lake, officials warning others

POSTED 11:40 AM, OCTOBER 7, 2014, BY [ASHTON EDWARDS](#) AND [ROBERT BOYD](#), UPDATED AT 09:51PM, OCTOBER 7, 2014

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October 2014

Utah Lake near Provo, Utah

Elevated levels of toxins from algae in the lake killed dog

Warnings to swimmers, boaters, anglers, and hunters

Symptoms: headache, fever, diarrhea, abdominal pain, nausea, vomiting, allergic reactions from skin contact

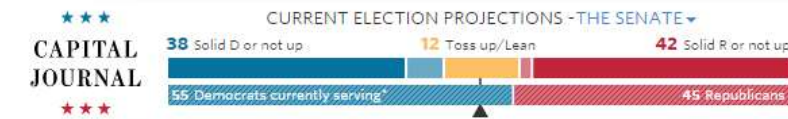
Impacts of Nutrient Pollution

Toledo tap water ban (>250,000 people)

July-August 2014

Cyanobacteria
(*Microcystis*)
produced
toxins in water
supply

Toxins may cause
neurological
problems,
paralysis,
seizures



CAPITAL JOURNAL DAYBREAK
Your essential guide to the 2014 midterm elections
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Washington and the nation
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U.S. NEWS

Algae Blooms Making Toledo Water Undrinkable Are Thriving Farm, Sewage-Treatment Runoff Into Lake Erie Are Feeding the Blooms Like Candy

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By ANDREA GALLO

Aug. 3, 2014 7:17 p.m. ET



Algae is seen near Toledo's water intake crib on Sunday in Lake Erie. AP

The algal bloom wreaking havoc on Toledo's water supply is thriving on the same things that make a happy potted plant: sunlight, water and lots of nutrients.



Popular Now

What's This?



RECOMMENDED STORIES

Impacts of Nutrient Pollution



July 2012

Cyanobacteria
(*blue-green
algae*) produced
toxins in ponds

Four cattle
consumed the
water and died
from the blue-
green algae
toxins.

A screenshot of the University of Georgia (UGA) Today news website. The header features the UGA logo and the text "UNIVERSITY OF GEORGIA" and "UGA Today". Below the header, there is a navigation bar with links for "All Releases", "Research News", "Honors & Awards", "University Events", "In the News", and "Faculty Experts". The main article is titled "Toxic algae to blame for cattle deaths in Gwinnett County, UGA determines" and is dated June 25, 2012. The article text describes how a recent perfect storm created conditions for a toxic algae bloom in ponds, leading to the deaths of four cattle. It mentions that pond owners should be vigilant about keeping livestock and pets out of water that has become discolored or opaque. The article also includes a photograph of a person in a boat testing the water in a pond. On the right side of the page, there is a sidebar with a "Sort all news by:" dropdown menu and a "News by selected interests:" section with various categories like "Culture / Living", "Environment", "Medical Science", and "Public Policy and Politics".

Impacts of Nutrient Pollution



Home > Reverse Osmosis Tackles Nitrates in Wyoming Wells

Reverse Osmosis Tackles Nitrates in Wyoming Wells

There's nothing more important for a municipality's reputation than being able to deliver clean, safe and good tasting drinking water to every person connected to its distribution system. People know they can turn on the tap with confidence in the unseen process that protects them.

Over a four-year period ending in 1998, that process was being closely studied by the City of Torrington, WY, a primarily agricultural community of nearly 6,000 situated on the North Platte River in the southeastern corner of the state. The city traces its roots back to 1889. The major crops in the area are corn, beans and alfalfa, and local industries include a sugar company and an ethanol plant.

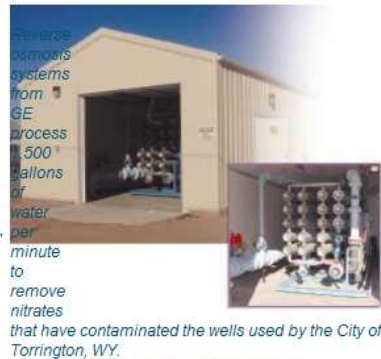
Torrington's citizens consume approximately 2.4 million gallons of water per day supplied by groundwater from multiple wells. The city has six certified operators maintaining the water system, and approximately 2,700 customer taps. The aquifer system is shallow, with some groundwater less than 20 meters below the surface and surrounded by sandy soils that are regularly irrigated. As a result, the city's water source is vulnerable to contamination by anything that migrates through the soil.

The City of Torrington's monitoring program, as well as a U.S. geological survey, revealed that its groundwater had widespread nitrate contamination. The contamination was traced to excessive inorganic nitrates in the soil from the application of commercial fertilizer. Organic nitrates, which usually originate from human sewage or livestock manure, were not a significant factor. Because all nitrates are very mobile in soil, they have a high potential for migrating into groundwater supplies.

The EPA's Maximum Level of Contamination for nitrates is 10 ppm, and some of Torrington's wells were found to exceed that limit. As a result, in 2000 the EPA told Torrington that it had to resolve the nitrate contamination problem promptly or be fined for noncompliance.

Choosing Reverse Osmosis

Equally concerned about the problem, Torrington immediately searched for a new well field with less contaminated source water. At the same time, it also



[Click here to enlarge image](#)



City of Torrington

Drinking water supply from shallow groundwater wells

In mid-late 1990's, groundwater discovered contaminated with nitrates

Exceeded 10 mg/L MCL

Traced to application of commercial fertilizer

In 2000, Torrington installed reverse osmosis water treatment system (~\$6 million)

Drilled more wells, use untreated water to irrigate

Nutrients and Designated Uses



Nutrient pollution can impact many of Wyoming's designated uses



Drinking Water

Recreation

Fisheries

Aquatic Life Other Than Fish

Wildlife

Agriculture

Scenic Values

Industry

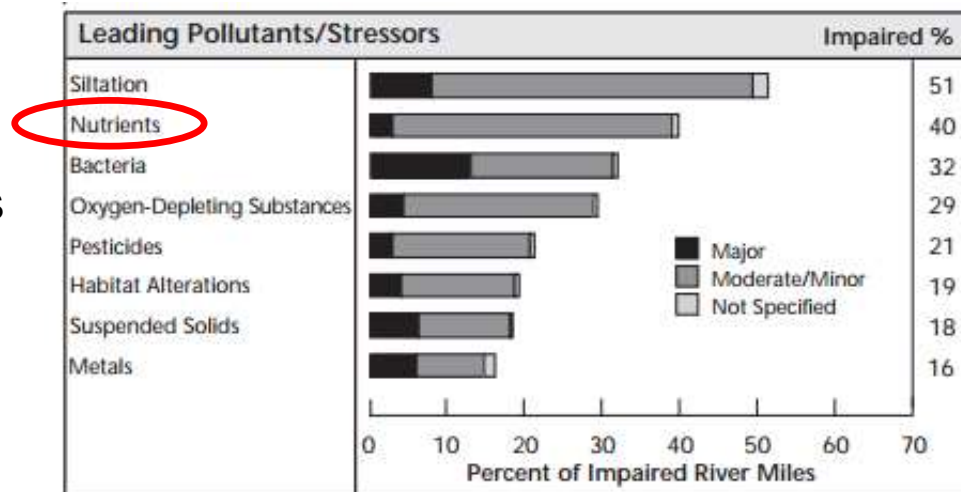
Fish Consumption

Nutrient Pollution History

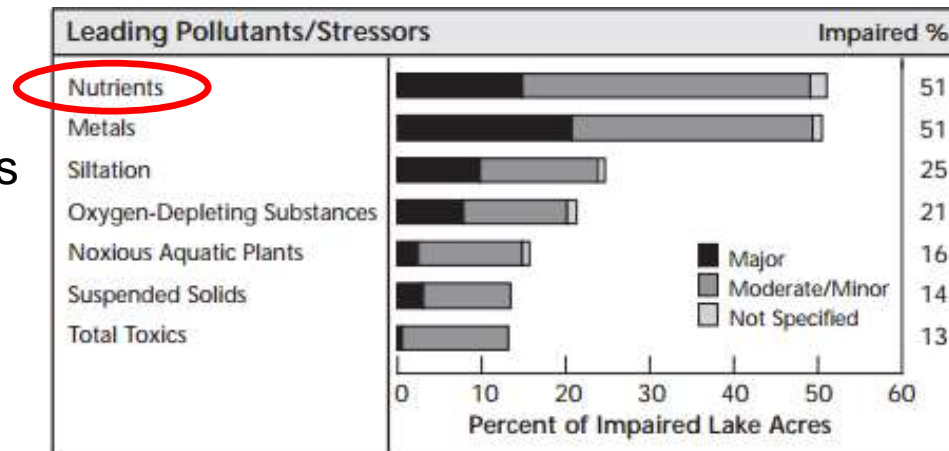


1996: In National Water Quality Inventory Report to Congress, EPA reported that nutrients were among the leading causes of water quality impairments in the U.S.

Streams and Rivers



Lakes and Reservoirs



Nutrient Pollution History



2014

National Summary Causes of Impairment in Assessed Rivers and Streams

[Description of this table](#)

Cause of Impairment Group	Miles Threatened or Impaired
Pathogens	160,041
Sediment	124,844
Nutrients	99,408
Organic Enrichment/Oxygen Depletion	85,464
Polychlorinated Biphenyls (PCBs)	78,332

National Summary Causes of Impairment in Assessed Lakes, Reservoirs, and Ponds

[Description of this table](#)

Cause of Impairment Group	Acres Threatened or Impaired
Mercury	7,557,195
Nutrients	3,106,249
Polychlorinated Biphenyls (PCBs)	2,848,252
Turbidity	1,467,234
Organic Enrichment/Oxygen Depletion	1,376,381

Nutrient Pollution History



1997: EPA initiated Clean Water Act Plan (CWAP) to address excess nutrients in the nation's surface waters.

CWAP included development of numeric criteria as a component.

Most states have used narrative water quality standards to protect designated uses (i.e., waters shall be free from) due to complexity and variability in nutrient/response relationships

Numeric Nutrient Criteria



Numeric criteria for total nitrogen and total phosphorus and response parameters (e.g., chlorophyll) are expected to more effectively protect designated uses from nutrient pollution because they can be:

- Incorporated into discharge permits
- Used to assess waters for impairment
- Used to develop Total Maximum Daily Loads (TMDLs)
- Used to facilitate watershed protection and restoration

Nutrient Pollution History



1998: EPA released *National Strategy for Development of Regional Nutrient Criteria*.

Set goal for states to adopt nutrient criteria by end of 2003.

2000-2001: EPA published recommended criteria for nutrients by waterbody type by region. Intended to be used by states and tribes as a starting point for criteria development.

- EPA's recommend nutrient criteria were based on regional reference sites (least impacted)
- Most states have *not* adopted these criteria

Nutrient Pollution History



2001: EPA recommended that states and tribes develop nutrient criteria plans (how and when they would adopt nutrient criteria).

States should adopt plans by the end of 2001 and adopt criteria by 2004.

2001: EPA provided additional guidance on developing plans, flexibilities, new timeframes for plan development and criteria adoption.

2008: DEQ, with assistance of TetraTech, published *Wyoming Nutrient Criteria Development Plan*

Nutrient Criteria Development Plan



WYOMING NUTRIENT CRITERIA DEVELOPMENT PLAN

Final
April 4, 2008



Prepared by
**Wyoming
Department of Environmental Quality**
and
Tetra Tech, Inc.
400 Red Brook Blvd., Suite 200
Owings Mills, MD 21117

6.0 SCHEDULE OF NUTRIENT CRITERIA DEVELOPMENT

6.1 Schedule and Milestones for Lakes and Reservoirs

2008-2010

- Inventory of existing lake and reservoir data
- Data compilation into integrated database
- Literature review for lake and reservoir nutrient criteria

2011

- Analysis of existing lake and reservoir data
- Design and implementation of additional data collection for lakes and reservoirs

2012

- Additional lake and reservoir sampling

2013

- Develop proposed lake and reservoir nutrient criteria

2015

- Stakeholder Review of Lake and Reservoir Nutrient Criteria

6.2 Schedule and Milestones for Streams and Rivers

2008-2010

- Inventory of existing data
- Data compilation into an integrated database
- Ongoing sampling of streams and rivers

2011

- Continue sampling of streams and rivers
- Analysis of existing data
- Design and implementation of supplemental data collection

2012

- Continue sampling of streams and rivers
- Evaluation of other stream and river classes (large rivers)
- Design and implementation, if needed, of sampling program for other stream and river classes

2012-2013

- Continue sampling of streams and rivers

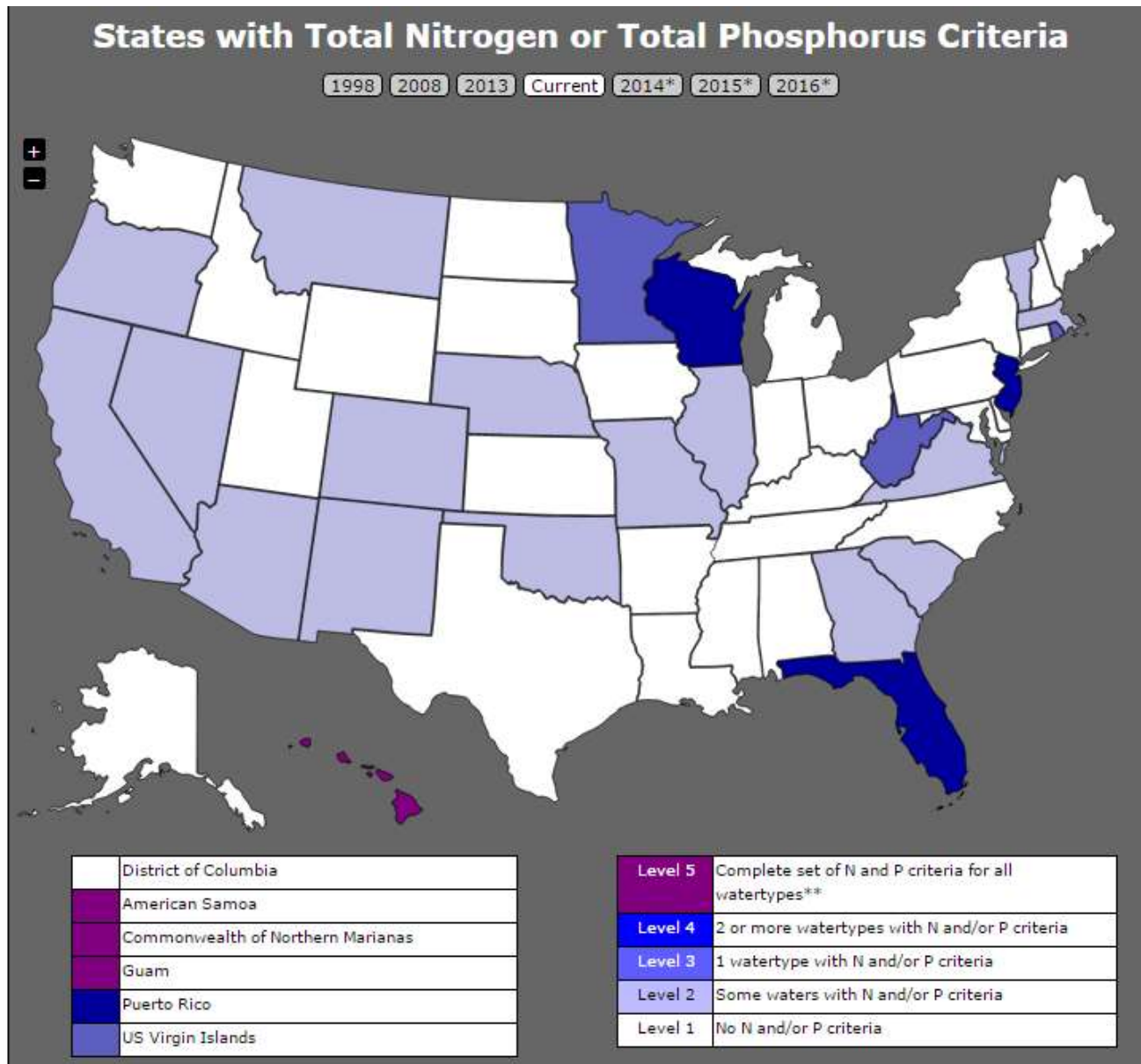
2014

- Develop proposed nutrient criteria for wadeable streams and rivers

2015

- Stakeholder review of nutrient criteria for wadeable streams and rivers
- Continued sampling as needed

National Status of Nutrient Criteria



October 2014

Nutrient Litigation - Florida



- 2008: Florida Wildlife Federation sued EPA to promulgate numeric nutrient standards for Florida waters (narrative insufficient).
- 2009: In Jan., EPA determined that numeric criteria were necessary to meet the requirements of the Clean Water Act and EPA intended to propose numeric nutrient standards.
- 2009: EPA entered consent decree within FWF. Committed to develop and promulgate criteria.

Much back and forth between EPA and Florida on numeric criteria, end result is that Florida developed and adopted criteria for most waters.



Nutrient Pollution History



- 2009: In Aug., Office of Inspector General Report [*EPA Needs to Accelerate Adoption of Numeric Nutrient Water Quality Standards*](#)
- 2009: EPA issued an [*Urgent Call to Action*](#) to address nutrient pollution
- 2010: EPA Administrator Jackson identified nutrients as a priority
- 2011: EPA Acting Administrator for Water issued a memo [*Working in Partnership with States*](#) to Reduce Nutrient Pollution

2011 EPA Framework Memo



- Gives states flexibility to:
 - Achieve near-term reductions via development of a Nutrient Reduction Strategy
 - While also developing Numeric Criteria
- Criteria for a category of waters by 2016 (streams or lakes)
- Results oriented: build from existing state work, but accelerate progress and demonstrate results
- Encourage collaborative approach between federal, state, local partners and other stakeholders



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 16 2011

OFFICE OF
WATER

MEMORANDUM

SUBJECT: Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions

FROM: Nancy K. Stoner
Acting Assistant Administrator

TO: Regional Administrators, Regions 1-10

This memorandum reaffirms EPA's commitment to partnering with states and collaborating with stakeholders to make greater progress in accelerating the reduction of nitrogen and phosphorus loadings to our nation's waters. The memorandum synthesizes key principles that are guiding and that have guided Agency technical assistance and collaboration with states and urges the Regions to place new emphasis on working with states to achieve near-term reductions in nutrient loadings.

Over the last 50 years, as you know, the amount of nitrogen and phosphorus pollution entering our waters has escalated dramatically. The degradation of drinking and environmental water quality associated with excess levels of nitrogen and phosphorus in our nation's water has been studied and documented extensively, including in a recent joint report by a Task Group of senior state and EPA water quality and drinking water officials and managers.¹ As the Task Group report outlines, with U.S. population growth, nitrogen and phosphorus pollution from urban stormwater runoff, municipal wastewater discharges, air deposition, and agricultural livestock activities and row crop runoff is expected to grow as well. Nitrogen and phosphorus pollution has the potential to become one of the costliest and the most challenging environmental problems we face. A few examples of this trend include the following:

- 1) 50 percent of U.S. streams have medium to high levels of nitrogen and phosphorus.
- 2) 78 percent of assessed coastal waters exhibit eutrophication.
- 3) Nitrate drinking water violations have doubled in eight years.

¹ *An Urgent Call to Action: Report of the State-EPA Nutrients Innovations Task Group*, August 2009.

Nutrient Reduction Strategy



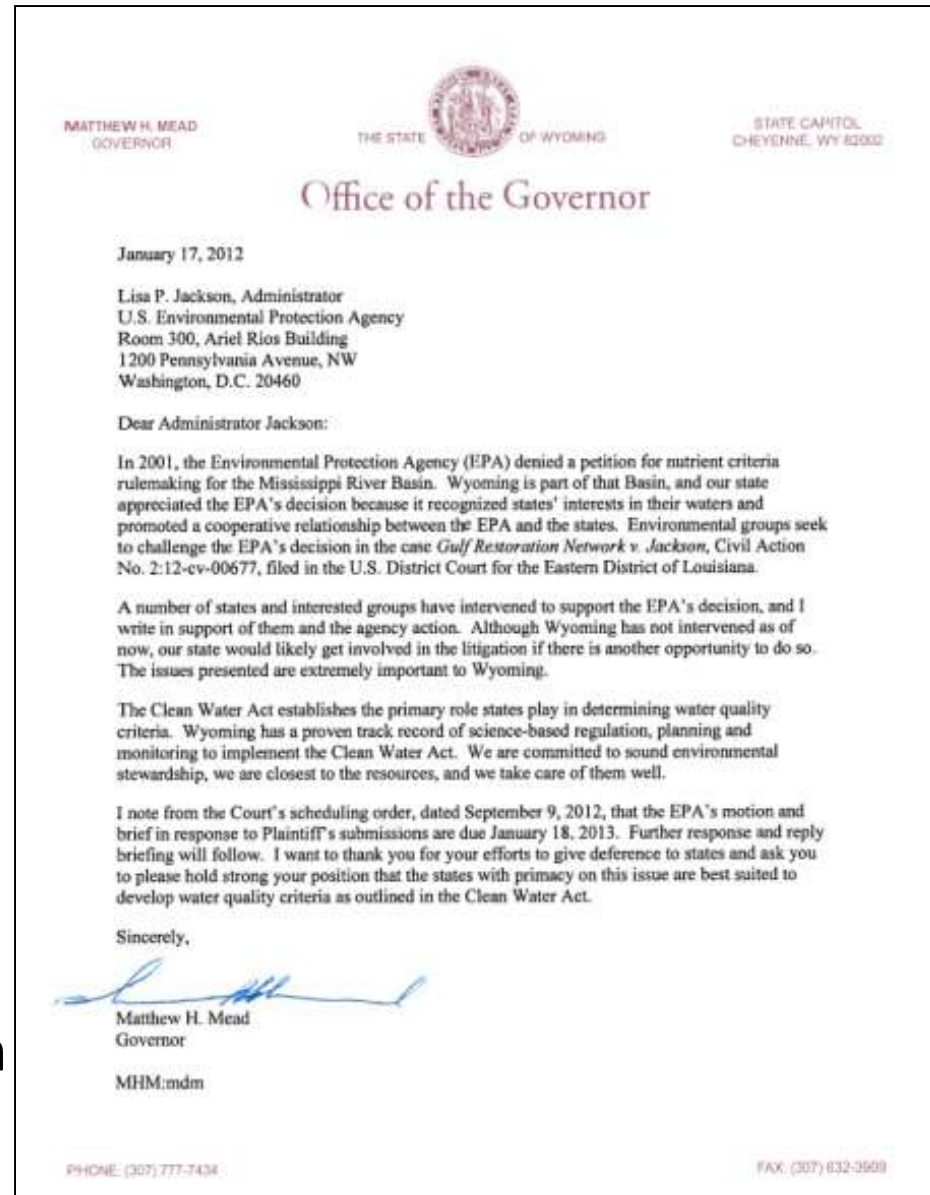
- EPA's Recommended Elements
 - Prioritize Watersheds for N & P Load Reductions
 - Set watershed load reduction goals based on best available info
 - Ensure effective permits (point sources, CAFOs, storm water) in targeted/priority watersheds
 - Address nutrient pollution from agricultural areas
 - Address nutrient pollution from storm water and septics
 - Identify ways to measure and verify reductions
 - Report activities and reductions annually
 - Develop a work plan for numeric phosphorus and nitrogen criteria

Nutrient Litigation - Mississippi

- 2008: Environmental groups (Gulf Restoration Network et. al.) petitioned EPA to force 10 mainstem Mississippi River Basin states to adopt numeric nutrient criteria and develop TMDLs to combat the Gulf of Mexico's hypoxic "Dead Zone."
- 2011: EPA rejected petition. More effective to build on existing work, work cooperatively with states and tribes (i.e., 2011 Framework Memo)
- 2012: Groups challenged EPA's rejection.



Emphasized state control
over development of water
quality criteria, as outlined in
the Clean Water Act



Numeric Nutrient Criteria – General Strategy



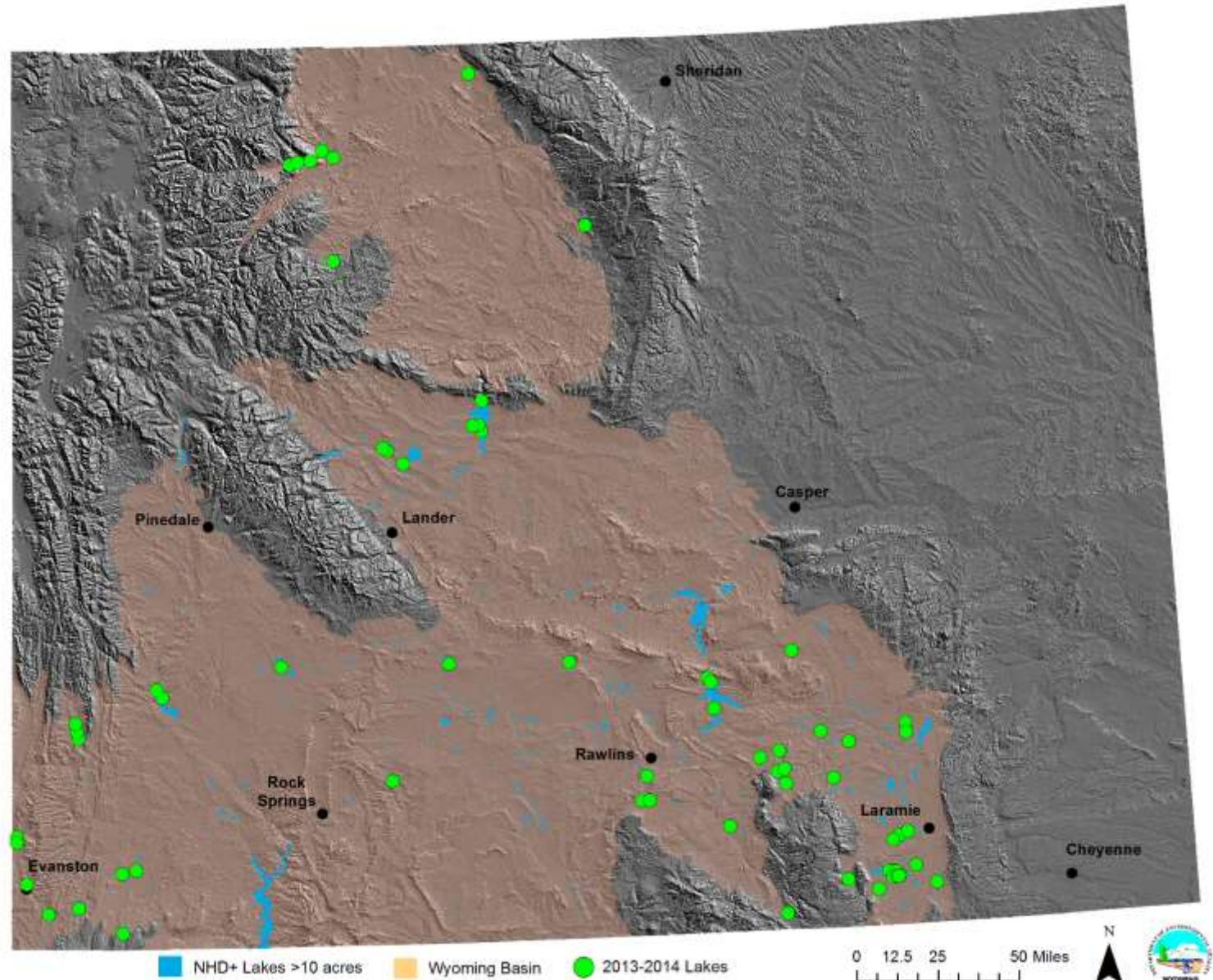
- Protect designated uses (aquatic life, recreation, drinking water)
- Reflect spatial variation (ecoregional, regional, watershed)
- Specific for different waterbody types
- Reflect temporal variability
- Criteria developed using multiple lines of evidence based on five standard approaches:
 - Distributional/Reference-Based
 - Stressor-response relationships
 - Scientific literature
 - Modeling
 - Dose-response experiments
- Nutrient criteria should include
 - Causal variables (total phosphorus, total nitrogen)
 - Response variables (chlorophyll a, biological attributes)
- Goal: Develop scientifically defensible, protective and reasonable criteria for Wyoming

Criteria Development Efforts



- WDEQ Nutrient data collection (biological, chemical, physical)
 - Streams (2005-present)
 - Lakes/Reservoirs (2002-present)
- Wyoming Basin Lakes & Reservoirs Nutrient Monitoring
 - Why Wyoming Basin? - Best existing data quantity/quality and distribution among regions (good starting point)
 - Objectives
 - Improve spatial/temporal data resolution and distribution with additional monitoring in 2013 and 2014
 - Explore stressor-responses, classification, reference?

Criteria Development Efforts – Wyoming Basin Lakes

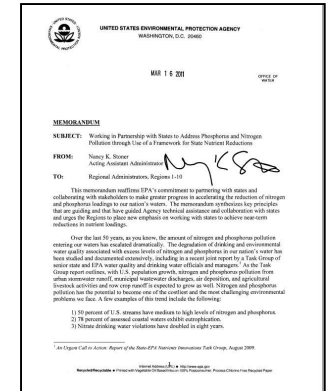


Nutrient Work Group



- Help DEQ address nutrient pollution in Wyoming through development of numeric criteria and a Nutrient Reduction Strategy

- Nutrient Reduction Strategy: 7 non-criteria elements



- Criteria Development: Nutrient Criteria Development Plan, evaluate approaches, how to incorporate into standards



Nutrient Work Group



- Help DEQ answer several important items which include:
 - How will criteria be written into standards (frequency/duration)?
 - How will criteria be implemented, timeframes?
 - How will we assess waters for nutrient impairments?
 - How will we incorporate criteria into permits?
 - What expectations do we set for wastewater facilities?
 - Considerations on variances from meeting nutrient criteria for some permitted facilities?
 - How do we factor in limits in treatment technology, economic considerations, funding?

Nutrient Work Group



- Entities impacted by and interested in nutrients in Wyoming

- Agriculture

- Business

- Conservation Districts

- Environmental Groups

- Industry (Mining, Oil and Gas)

- Local Governments

- Technical Experts

- Land and Resource Management

- DEQ (Watershed, Water/Wastewater, WYPDES), EPA

- Governor's Office

Wastewater Representatives

- Major Mechanical Plants

- Major Lagoon

- Minor Lagoon

- Private Lagoon System

Drinking Water

- Facilities that Use Surface Water

Nutrient Work Group



2014: Held first stakeholder group meeting in March

- Presented background on nutrient pollution, litigation, nutrient reduction strategy
- Presented summary of nutrient criteria development efforts and approaches
- Presented approaches other states have taken to address wastewater facilities

Nutrient Criteria and Wastewater



- Nutrient concentrations (total nitrogen, total phosphorus) to protect designated uses are generally very, very low
- If little or no stream dilution is available, dischargers will find it difficult or impossible to meet the standards



- In some case, standards may be below the limits of current treatment technology
- Upgrading facilities to meet criteria may be cost prohibitive

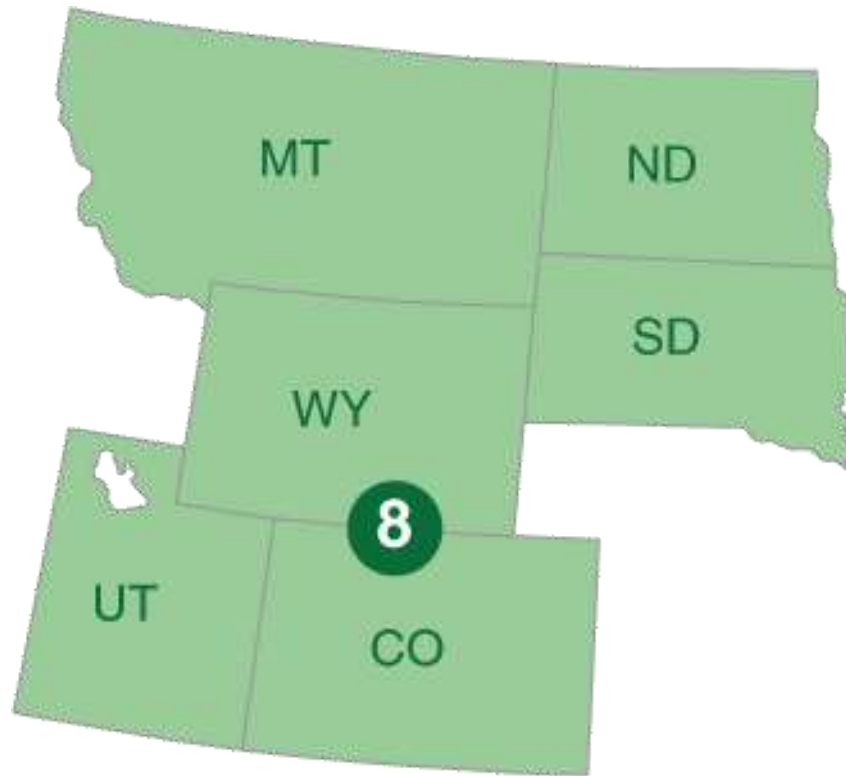
Nutrient Pollution and Wastewater



- States have utilized different ways to modify effluent limits where meeting receiving water criteria would cause unreasonable economic burdens or where the standards are technologically infeasible
- States have also looked to impose effluent limits on dischargers to make near-term progress on nutrient reduction (nutrient reduction strategy)



Nutrient Pollution and Wastewater



Montana: adopting statewide criteria, using general or individual variances for discharges (2014)

Colorado: adopted interim criteria, permitting regulations for numeric effluent limits (2012)

Utah: Nutrient Reduction Strategy, permitting regulations for effluent limits (2014 possibly)

North Dakota: Nutrient Reduction Strategy

Nutrient Pollution Webpage



deq.state.wy.us/wqd/watershed/surfacestandards/Pages/Nutrients.asp

DEQ in Our... Inbox 30 - Lindsay.patterson... deq.state.wy.us/wqd/wat... State of Wyoming - Cal... DEQ Water-UAA Criteria

deq.state.wy.us/wqd/watershed/surfacestandards/Pages/Nutrients.asp

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Nutrient Pollution

[Wyoming Nutrient Work Group](#) | [Numeric Nutrient Criteria](#) | [Wyoming Nutrient Reduction Strategy](#)

Nutrients (nitrogen and phosphorus), in appropriate amounts, are essential to healthy aquatic ecosystems. Excessive nutrients, or nutrient pollution, however, can result in excessive growth of vegetation (i.e., aquatic plants and algae) that can lead to oxygen depletion, high pH, fish kills, and general degradation of aquatic resources. Drinking water supplies with excessive nutrients require costly treatment, while surface waters with nutrient pollution can impact use of the water for recreation, livestock, and wildlife.

National water quality summaries consistently identify excessive nutrients as one of the leading causes of impairments to the nation's waters ([EPA National Summary](#)). As a result, the U.S. Environmental Protection Agency has made addressing nutrients pollution one of their and states' highest priorities.

To address nutrient pollution in Wyoming, the Wyoming Department of Environmental Quality, Water Quality Division, with the assistance of the [Wyoming Nutrient Work Group](#) is working on developing [numeric nutrient criteria](#) and a [nutrient reduction strategy](#).

Contact
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lindsay.patterson@wyo.gov

Search DEQ:

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Water Quality
Current Events
Discharge Monitoring Reports
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Groundwater Section
Operator Certification
State Revolving Fund
Underground Injection Control
Water and Wastewater Program
Water Quality Surface Water Standards
Watershed Protection Program
WYPOES Coalbed Methane
Concentrated Animal Feeding Operation (CAFO)
WYPOES Point Source
WYPOES Storm Water Permits

Public Resources
Advisory Boards

Nutrient Pollution: Work Group

[Return to Watershed Protection Main Page](#)

[Wyoming Nutrient Work Group](#) | [Numeric Nutrient Criteria](#) | [Wyoming Nutrient Reduction Strategy](#)

The purpose of the Wyoming Nutrient Work Group (NWWG) is to assist the Wyoming Department of Environmental Quality address nutrient pollution in Wyoming through development and implementation of numeric nutrient criteria and a nutrient reduction strategy.

The NWWG is composed of a comprehensive set of stakeholders representing agriculture, industry, municipalities, water and wastewater management, land and resource management agencies, and the professional.

Sections of Group

Meetings
March 11, 2014

Agendas
(Meeting of participants about 12 minutes into the recording.)

Presentations
[Nutrient Background Submittal Meeting](#)
[Nutrient Criteria Development](#)
[Update...](#)

Guests
Lindsay Patterson, 307-777-7079

Nutrient Work Group



To participate in the Nutrient Work Group, contact

Lindsay Patterson at

Lindsay.Patterson@wyo.gov

or

307-777-7079

Next Steps

- Finalize the work group and set next meeting
- Send out revised Nutrient Criteria Development Plan for input
- Give more detailed presentation on options for Nutrient Reduction Strategy; what have other states done
- Give an update on criteria development



Questions?



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